IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS

In re Patent Application of: **RAYNOR ET AL.**	)	
Serial No. **10/677,850**	)	Examiner: **B. SINES**
Filing Date: **October 2, 2003**	)	Art Unit: **1743**
Confirmation No. **5132**	)	Attorney Docket No. **03EDI22652634**
For: **METHODS AND APPARATUS FOR SENSOR ALIGNMENT**	)	

APPELLANT'S APPEAL BRIEF

MS Appeal Brief-Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Submitted herewith is Appellant's Appeal Brief together with the requisite $510.00 Large entity fee for filing a brief. If any additional extension and/or fee is required, authorization is given to charge Deposit Account No. **01-0484.**

(1) Real Party in Interest

The real party in interest is STMicroelctronics, LTD, assignee of the present application as recorded at reel 15558, frame 760.

(2) Related Appeals and Interferences

At present there are no related appeals or interferences.

(3) Status of the Claims

Claims 39-41, 43-58, and 60-65 are pending in the application, all of which being appealed herein. Claims 1-38, 42, 59 and 66-80 have been cancelled.

(4) Status of the Amendments

All amendments have been entered and there are no further pending amendments. A copy of the claims involved in this appeal is attached hereto as Appendix A.

(5) Summary of the Claimed Subject Matter

The present invention, as recited in independent Claim 39, is directed to a method of attaching a sensor **14** and a housing **24** to opposite sides of a mounting substrate **10**. See page 3, paragraph 13 through page 5, paragraph 19 and FIG. 1 of the present application (reproduced below).

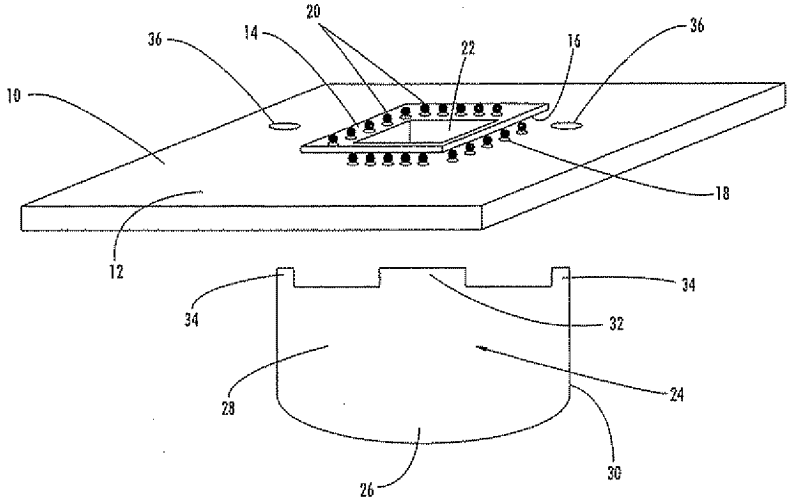

FIG. 1 of the Present Application

The sensor **14** comprises an integrated circuit die having a sensing face **16** and comprising a sensing area and at least one signal output contact thereon. The mounting substrate **10** has a circuitry face **12** and at least one signal input contact thereon. The mounting substrate **10** also has an opening **22**

therethrough and at least one landing **18** adjacent the opening.

The method comprises positioning the sensing area over the opening **22** so that the at least one signal output contact of the sensor **14** contacts the at least one signal input contact of the mounting substrate **10**. The method further comprises attaching the sensor **14** to the mounting substrate **10** in a flip-chip arrangement with at least one bump bond **20** interposed between the at least one signal output contact of the sensor **14** and the at least one signal input contact of the mounting substrate **10** to pass signals therethrough. The at least one bump bond **22** is associated with the at least one landing **18** so that the at least one bump bond **22** is aligned with the at least one signal output contact of the sensor **14**. The housing **24** is positioned to contact the mounting substrate **10** so that the housing and the sensor **14** are in alignment.

Independent Claim 57 is also directed to a method of attaching a sensor **14** to a mounting substrate **10**. See page 3, paragraph 13 through page 5, paragraph 19 and FIG. 1 of the present application. The sensor **14** comprises an integrated circuit die having a sensing face **16** comprising a sensing area and at least one signal output contact thereon. The mounting substrate **10** has a circuitry face **12** and at least one signal input contact thereon. The mounting substrate **10** also has an opening **22** therethrough and at least one landing **18** adjacent the opening **22**.

The method comprises positioning the sensing area of the sensor **14** over the opening **22** in the mounting substrate **10**, and attaching the sensor **14** to the mounting substrate **10** in a flip-chip arrangement with at least one bump bond **20** interposed between the at least one signal output contact of the sensor **14**

and the at least one signal input contact of the mounting substrate **10** to pass signals therethrough. The at least one bump bond **20** is associated with the at least one landing **18** so that the at least one bump bond **20** is aligned with the at least one signal output contact of the sensor **14**.

(6) Grounds of Rejection to be Reviewed On Appeal

Claims 39-41, 43-58 and 60-65 stand rejected under 35 U.S.C. §112, first paragraph.

Claims 39-41, 43, 44, 46, 48-54, 57, 58, 60, 61 and 63-65 stand rejected under 35 U.S.C. §103 as being unpatentable over the Venkat et al. patent in view of the Bauer et al. patent and in further view of the Casson et al. patent.

Claims 45 and 62 stand rejected under 35 U.S.C. §103 as being unpatentable over the Venkat et al. patent in view of the Bauer et al. patent and the Casson et al. patent and in further view of the Glenn patent.

Claim 47 stands rejected under 35 U.S.C. §103 as being unpatentable over the Venkat et al. patent in view of the Bauer et al. patent and the Casson et al. patent and in further view of the Bidiville patent.

Claims 55 and 56 stand rejected under 35 U.S.C. §103 as being unpatentable over the Venkat et al. patent in view of the Bauer et al. patent and the Casson et al. patent and in further view of the Groger et al. patent.

(7) Arguments

I. The Claims Are Supported By The Specification

The Examiner rejected the claims as including subject matter not supported by the specification. In particular, independent Claims 39 and 57 each recite that the sensor

comprises "an integrated circuit die." The Examiner has taken the position that an integrated circuit die is not supported by the specification.

The specification makes reference to a "chip" in paragraphs 11-13. A "chip" is a term for an integrated circuit die. The die, which is a small block of semiconducting material on which a given functional circuit is fabricated, is typically produced in large batches on a single wafer.

The Appellants submit that these terms are readily understood by those skilled in the art. The Appellants thus submit that the specification supports recitation of "integrated circuit die" in the claims.

II. Independent Claims 39 and 57 are Patentable

The Examiner rejected independent Claims 39 and 57 over the Venkat et al. patent in view of the Bauer et al. patent and in further view of the Casson et al. patent.

The Venkat et al. patent discloses an integrated lens and aperture plate for an optical sensor equipped integrated chip in which the lens and the aperture plate are molded as one piece with the lens at the appropriate location so that the lens aligns with the location of the optical sensor. Referring initially to FIG. 2 of Venkat et al. (reproduced below), a sensor **32** is attached to a mounting substrate **36**. The sensor **32** is attached via the pins extending therefrom by inserting the pins through the openings in the mounting substrate **36**.

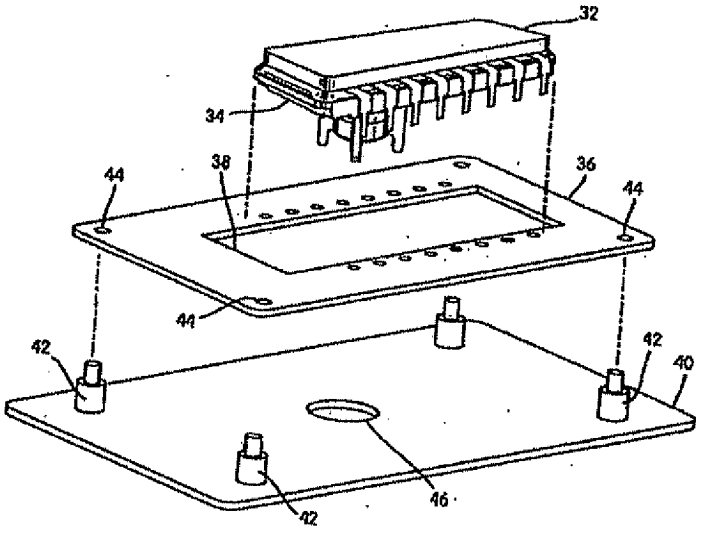

FIG. 2 of Venkat et al.

As correctly noted by the Examiner, Venkat et al. fails to disclose the use of bump bonding for attaching the sensor to the mounting substrate. The Examiner cited the Bauer et al. patent, and in particular FIG. 8 therein (reproduced below), as disclosing the use of bump bonding using solder bump **120** in attaching an optical sensor **22** to a mounting base substrate **28** that comprises circuitry (e.g., conductive strip **30**).

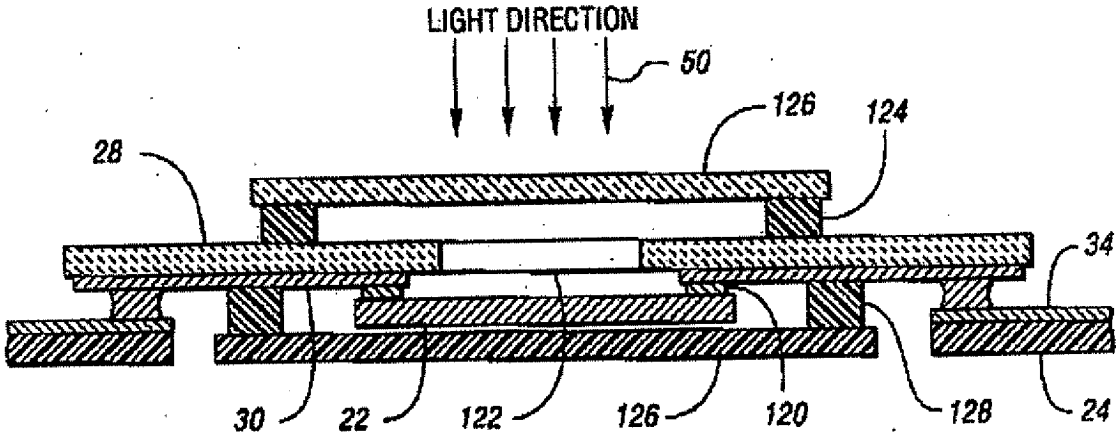

FIG. 8 of Bauer et al.

In addition, the Examiner cited Casson et al. as disclosing the attachment of a chip device to a flexible printed circuit board using solder bumps to facilitate a secure electrical connection. The Examiner referenced column 16, lines 52-68 as disclosing self-alignment of the chip device to the mounting substrate comprising a flexible printed circuit board using a solder bump bonding methodology that also comprises a heating step.

The Examiner has taken the position that a combination of known elements as disclosed by the cited prior art references would have been obvious to try. The Appellants respectfully disagree, particularly since Venkat et al. simply fails to teach or suggest that the sensor **32** is mounted in a flip-chip arrangement. Instead, the sensor **32** is a packaged chip or die with a plurality of pins extending therefrom.

A readily understood by those skilled in the art, a "flip chip" is one type of mounting used for semiconductor devices (such as integrated circuit chips), which uses solder bumps instead of wire bonds or pins. In other words, a flip chip arrangement does not require any wire bonds or pins, as disclosed by Venkat et al.

The solder bumps are deposited on the chip pads, located on the top side of the wafer. To mount the chip to external circuitry on a circuit board, it is flipped around, i.e., the top side is facing down towards the mounting area. The solder bumps are used to connect directly to the associated external circuitry. Even though Venkat et al. discloses that the sensor **32** is mounted face down, it simply fails to teach or suggest that the sensor **32** may be mounted in a flip-chip arrangement in which wire bonds or pins are not required.

In addition, Venkat et al. does not make any reference

to bump bonding since the sensor **32** is not in a flip-chip arrangement. While bump bonding is more commonplace today, the bump bonds in Bauer et al. are attached to a long conductive strip **30** which extends from near the aperture **122** outwards to the edge of the base substrate **28**, as shown in FIG. 8. The same conductive strip is used in all embodiments. It is also clear from FIG. 1 in Bauer et al. (reproduced below) that the conductive strip is relatively wide. Bauer et al. is thus silent regarding the issue of alignment. In many of the embodiments, conventional wire contacts **32** are used in Bauer et al. for aligning the optical sensor **22** with the substrate **28**.

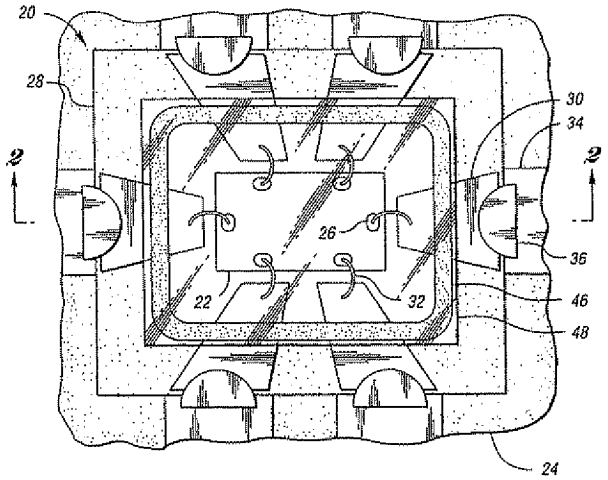

FIG. 1 of Bauer et al.

In Casson et al., the illustrated flip chip **10** fails to disclose a mounting substrate having an opening therethrough as in the claimed invention. Reference is directed to column 7, lines 7-21 of Casson et al., which provides:

> "Referring to FIGS. 1a and 1b, a flip chip is an unpackaged silicon integrated circuit

chip, such as flip chip **10**, having a silicon chip **17** containing the integrated circuit components and coated with an active side passivation layer **11a** on the active side **12** to protect its components from environmental contaminants. It has markings **13** applied to its back side **14** for identification purposes, and a back side passivation layer **11b** coated on back side **14** to protect the markings. It also has a number of aluminum/copper bonding pads, such as bonding pad **15**, which are located at various positions on the flip chip's active side for making electrical connections with a substrate. Solder bumps, such as solder bump **16**, are further attached to these bonding pads." (Emphasis added).

As best illustrated in FIGS. 1a and 1b (reproduced below) and as stated above, Casson et al. teaches away from an opening in a mounting substrate associated with the flip chip **10** because of reflow of the soldering between the bonding pads **15** and the solder bumps **16** for providing the electrical connection.

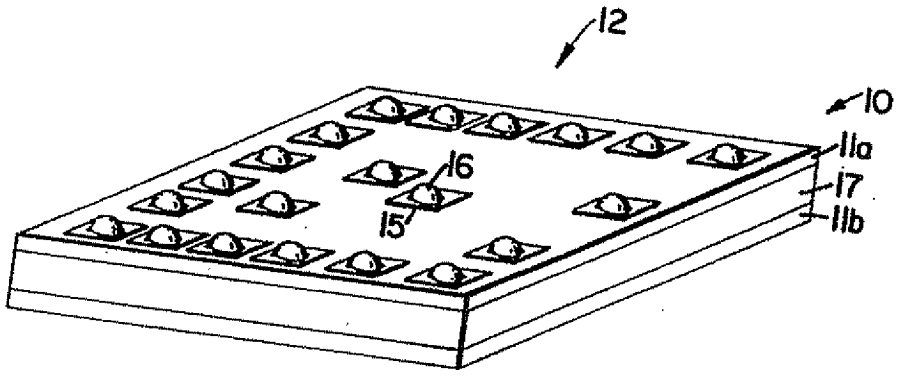

FIG. 1A of Casson et al.

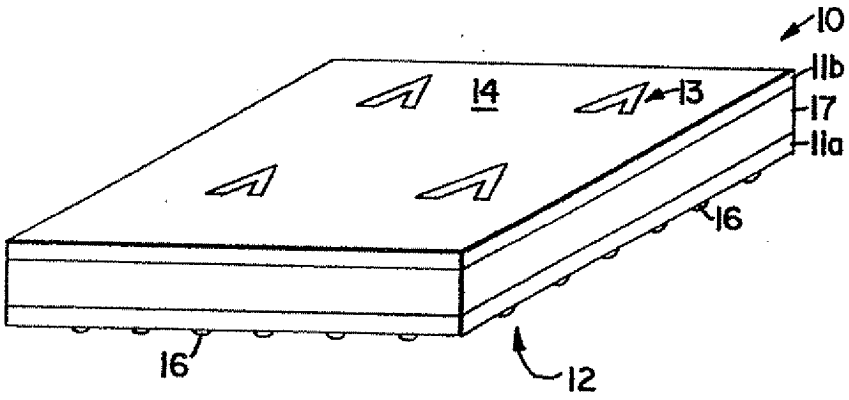

FIG. 1B of Casson et al.

As correctly noted by the Examiner in column 16, lines 52-68 of Casson et al., a solder composition is formed by reflowing solder paste located on the corresponding active contact pad on the circuit board such that a solder bump located on the corresponding bonding pad on the flip chip is allowed to self-align with the corresponding active contact pad and such that the solder paste mixes with the solder bump, and wherein each electrical connection is formed concurrently by applying heat to the circuit board and flip chips as a whole after the flip chips have been placed on the circuit board in a manner which allows for unobstructed motion of the flip chips during reflow.

If there was an opening in the mounting substrate associated with the flip chip **10** in Casson et al. as in the claimed invention, then the soldering between the bonding pads **15** and solder bumps **17** would not be able to reflow as necessary for providing the desired electrical connection. As noted above, each electrical connection in Casson et al. is formed concurrently by applying heat to the circuit board and to the flip chips **10** as a whole after the flip chips have been placed on the circuit board in a manner which allows for unobstructed

motion of the flip chips during reflow.

The Appellants submit that one skilled in the art would infer upon reading Venkat et al. that the wire bonds, together with their corresponding apertures, would not be necessary for ensuring an accurate alignment of the IC with the PCB. Venkat et al. is concerned with alignment of an integrated circuit sensor and the lens, and the approach taught is to integrate the lens with an aperture plate that also receives the IC **32**. In Venkat et al., conventional wire contacts are used for aligning the optical sensor IC **32** with the substrate. The whole sensor/aperture plate/lens is attached to one side of the substrate. Therefore, Venkat et al. is not concerned with the precise alignment of the sensor and substrate.

In Bauer et al., since the conductive strip used to attach to the bump bonds is relatively wide, Bauer is silent regarding the issue of alignment. Moreover, in many of the illustrated embodiments, conventional wire contacts **32** are used for aligning the optical sensor **22** with the substrate **28**.

In Casson et al., self-alignment of the solder bump with the flip chip is based on the solder paste mixing with the solder bumps during the heating. This requires an unobstructed motion of the flip chip during reflow - and inclusion of an opening in the mounting substrate adjacent the flip chip would impede the reflow of the solder paste.

It thus appears that the Examiner is using impermissible hindsight reconstruction to modify the Venkat et al. patent in view of the Bauer et al. patent and in further view of the Casson et al. patent. The prior art references, individually or in combination, do not teach or suggest a mounting substrate also having an opening therethrough and at least one landing adjacent the opening, and attaching the sensor

to the mounting substrate via at least one bump bond interposed between the at least one signal output contact of the sensor and the at least one signal input contact of the mounting substrate to pass signals therethrough, with the at least one bump bond being associated with the at least one landing so that the at least one bump bond is aligned with the at least one signal output contact of the sensor.

Independent Claim 39 recites that the at least one bump bond is associated with the at least one landing so that the at least one bump bond is aligned with the at least one signal output contact of the sensor. The at least one landing and bump bond are provided at specific locations. This specific arrangement of lands and bump bonds may provide an advantageous effect of improving the alignment of the image sensor with the mounting substrate. The bump bonds may be heated to melt the solder to make an electrical connection between the signal output contacts of the image sensor **14** and the PCB lands **18**, as shown in FIG. 1 associated with the Appellants' specification. As the spot bump bonds melt they try to minimize forces in their surface tension and thus deform evenly. There is thus a net effect of this action to draw the image sensor into a precise alignment with the aperture.

The bump bonds and landings adjacent the opening in the mounting substrate in the claimed invention thus provide an advantageous effect of actually improving the alignment of the sensor with the mounting substrate. This is not intuitively the case, as movement caused by the melting of the bump bonds would have normally been considered by one skilled in the art at the time of the invention to introduce a further inaccuracy or source of error in the alignment. However, the Appellants have found that counter to these expectations, the bump bonds actually help

with the alignment.

Accordingly, it is submitted that independent Claim 39 is patentable over the Venkat et al. patent in view of the Bauer et al. patent and in further view of the Casson et al. patent. Independent Claim 57 is similar to independent Claim 39. Therefore, it is submitted that this claim is also patentable over the Venkat et al. patent in view of the Bauer et al. patent and in further view of the Casson et al. patent.

In view of the patentability of independent Claims 39 and 57, it is submitted that dependent Claims 40-41, 43, 44, 46, 48-54, 58, 60, 61 and 63-65, which include yet further distinguishing features of the invention are also patentable. These dependent claims need no further discussion herein.

III. Dependent Claims 45 and 62 are Patentable

The Examiner rejected dependent Claims 45 and 62 over the Venkat et al. patent in view of the Bauer et al. patent and the Casson et al. patent and in further view of the Glenn patent. The subject matter of dependent Claims 45 and 62 is directed to the sensor comprising at least one of a charge-coupled device and a CMOS image sensor.

As correctly noted by the Examiner, Venkat et al., Bauer et al. and Casson et al. fail to disclose this feature of the claimed invention. Consequently, the Examiner cited Glenn as disclosing a sensor comprising a charge-coupled device. The Examiner has taken the position that the charge coupled device is functionally equivalent to the optical sensing device disclosed by Venkat et al., and that it would have been obvious to one skilled in the art at the time of the invention to incorporate a charge coupled device with the device disclosed by Venkat et al.

The Appellants submit that Glenn fails to supply the

noted deficiencies of Venkat et al., Bauer et al. patent and Casson et al. as discussed above in section II. In view of the patentability of independent Claims 39 and 57, it is submitted that dependent Claims 45 and 62, which include yet further distinguishing features of the invention are also patentable.

IV. Dependent Claim 47 is Patentable

The Examiner rejected dependent Claim 47 over the Venkat et al. patent in view of the Bauer et al. patent and the Casson et al. patent and in further view of the Bidiville patent. The subject matter of dependent Claim 47 is directed to the image sensing area comprises a photodiode array.

As correctly noted by the Examiner, Venkat et al., Bauer et al. and Casson et al. fail to disclose this feature of the claimed invention. Consequently, the Examiner cited Bidiville as disclosing an image sensing area comprising a photodiode array. The Examiner has taken the position that the photodiode array is functionally equivalent to the optical sensing device disclosed by Venkat et al., and that it would have been obvious to one skilled in the art at the time of the invention to incorporate a photodiode array with the device disclosed by Venkat et al.

The Appellants submit that Bidiville fails to supply the noted deficiencies of Venkat et al., Bauer et al. patent and Casson et al. as discussed above in section II. In view of the patentability of independent Claims 39 and 57, it is submitted that dependent Claim 47, which includes yet further distinguishing features of the invention is also patentable.

V. Dependent Claims 55 and 56 are Patentable

The Examiner rejected dependent Claims 55 and 56 over

the Venkat et al. patent in view of the Bauer et al. patent and the Casson et al. patent and in further view of the Groger et al. patent. The subject matter of dependent Claim 55 is directed to the housing comprising a matter delivery system for delivering a bio-optical analyte to the sensor, and the subject matter of dependent Claim 56 is directed to the matter delivery system further delivering a bio-optical reagent to the sensor.

As correctly noted by the Examiner, Venkat et al., Bauer et al. and Casson et al. fail to disclose this feature of the claimed invention. Consequently, the Examiner cited Groger et al. as disclosing a biological sensing system incorporating the use of an optical sensor. The Examiner has taken the position that it would have been obvious to one skilled in the art at the time of the invention to incorporate an optical detection system with the device disclosed by Venkat et al.

The Appellants submit that Groger et al. fails to supply the noted deficiencies of Venkat et al., Bauer et al. patent and Casson et al. as discussed above in section II. In view of the patentability of independent Claims 39 and 57, it is submitted that dependent Claims 55 and 56, which includes yet further distinguishing features of the invention are also patentable.

VI. Conclusion

In view of the foregoing arguments, it is submitted that all of the claims are patentable over the prior art. Accordingly, the Board of Patent Appeals and Interferences is respectfully requested to reverse the earlier unfavorable decision by the Examiner.

In Re Patent Application of:
RAYNOR ET AL
Serial No: **10/677,850**
Filing Date: **October 2, 2003**

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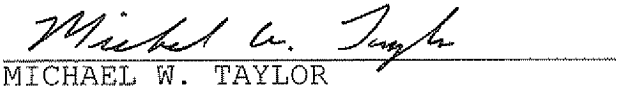
Respectfully submitted,



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APPENDIX A - CLAIMS ON APPEAL
FOR U.S. PATENT APPLICATION SERIAL NO. 10/677,850

Claims 1-38 (Cancelled).

39. (Previously Amended) A method of attaching a sensor and a housing to opposite sides of a mounting substrate, the sensor comprising an integrated circuit die having a sensing face and comprising a sensing area and at least one signal output contact thereon, the mounting substrate having a circuitry face and at least one signal input contact thereon, the mounting substrate also having an opening therethrough and at least one landing adjacent the opening, the method comprising:

positioning the sensing area over the opening so that the at least one signal output contact of the sensor contacts the at least one signal input contact of the mounting substrate;

attaching the sensor to the mounting substrate in a flip-chip arrangement with at least one bump bond interposed between the at least one signal output contact of the sensor and the at least one signal input contact of the mounting substrate to pass signals therethrough, with the at least one bump bond being associated with the at least one landing so that the at least one bump bond is aligned with the at least one signal output contact of the sensor; and

positioning the housing in contact with the mounting substrate so that the housing and the sensor are in alignment.

40. (Previously Presented) A method according to Claim 39, wherein dimensions of the opening are at least equal to

dimensions of the sensing area.

41. (Previously Presented) A method according to Claim 39, wherein dimensions of the opening are at least equal to dimensions of the sensing face.

Claim 42 (Cancelled).

43. (Previously Presented) A method according to Claim 39, wherein the at least bump bond comprises a plurality of bump bonds around a perimeter of the opening.

44. (Previously Presented) A method according to Claim 39, wherein positioning the sensing area comprises pressing the sensor against the mounting substrate; and wherein attaching the sensor to the mounting substrate comprises heating the at least one bump bond so that it melts to draw the sensor into alignment over the opening.

45. (Previously Presented) A method according to Claim 39, wherein the sensor comprises at least one of a charge-coupled device and a CMOS image sensor.

46. (Previously Presented) A method according to Claim 39, wherein the sensing area comprises an image sensing area.

47. (Previously Presented) A method according to Claim 46, wherein the image sensing area comprises a photodiode array.

48. (Previously Presented) A method according to Claim 39, wherein the sensor comprises a light sensitive sensor for use

with a bio-optical system.

49. (Previously Presented) A method according to Claim 39, wherein the mounting substrate comprises a printed circuit board.

50. (Previously Presented) A method according to Claim 39, wherein the housing comprises a formation extending therefrom; and wherein positioning the housing comprises mating the formation with the opening in the mounting substrate.

51. (Previously Presented) A method according to Claim 39, wherein the housing comprises projections extending therefrom; wherein the mounting substrate includes additional openings therethrough; and wherein positioning the housing comprises mating the projections with the additional openings in the mounting substrate.

52. (Previously Presented) A method according to Claim 39, wherein the housing comprises a lens.

53. (Previously Presented) A method according to Claim 52, wherein the lens is separable from the housing.

54. (Previously Presented) A method according to Claim 52, wherein the lens is threadably attached to the housing.

55. (Previously Presented) A method according to Claim 39, wherein the housing comprises a matter delivery system for delivering a bio-optical analyte to the sensor.

56. (Previously Presented) A method according to Claim 55, where the matter delivery system further delivers a bio-optical reagent to the sensor.

57. (Previously Amended) A method of attaching a sensor to a mounting substrate, the sensor comprising an integrated circuit die having a sensing face comprising a sensing area and at least one signal output contact thereon, the mounting substrate having a circuitry face and at least one signal input contact thereon, the mounting substrate also having an opening therethrough and at least one landing adjacent the opening, the method comprising:

positioning the sensing area of the sensor over the opening in the mounting substrate; and

attaching the sensor to the mounting substrate in a flip-chip arrangement with at least one bump bond interposed between the at least one signal output contact of the sensor and the at least one signal input contact of the mounting substrate to pass signals therethrough, with the at least one bump bond being associated with the at least one landing so that the at least one bump bond is aligned with the at least one signal output contact of the sensor.

58. (Previously Presented) A method according to Claim 57, wherein dimensions of the opening are at least equal to dimensions of the sensing area.

Claim 59 (Cancelled).

60. (Previously Presented) A method according to Claim 57, wherein the at least bump bond comprises a plurality of bump

bonds around a perimeter of the opening.

61. (Previously Presented) A method according to Claim 57, wherein positioning the sensing area comprises pressing the sensor against the mounting substrate; and wherein attaching the sensor to the mounting substrate comprises heating the at least one bump bond so that it melts to draw the sensor into alignment over the opening.

62. (Previously Presented) A method according to Claim 57, wherein the sensor comprises at least one of a charge-coupled device and a CMOS image sensor.

63. (Previously Presented) A method according to Claim 57, wherein the sensing area comprises an image sensing area.

64. (Previously Presented) A method according to Claim 57, wherein the sensor comprises a light sensitive sensor for use with a bio-optical system.

65. (Previously Presented) A method according to Claim 57, wherein the mounting substrate comprises a printed circuit board.

Claims 66-80 (Cancelled).

APPENDIX B – EVIDENCE APPENDIX PURSUANT TO 37 C.F.R. § 41.37(c)(1)(ix)

None.

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APPENDIX C – RELATED PROCEEDINGS APPENDIX
PURSUANT TO 37 C.F.R. § 41.37(c)(1)(x)

None.